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Metropolitan Moanings

There exists, in certain quarters, an erroneous notion that a scheme set out on paper is an organisation, whereas usually it is merely an expression of wishful thinking. Into this category enter the minutes of some committees, and sub-committees due nearly always to the restriction of their activities to attending, or apologising for absence from, the meetings.

An example of good committee, upon which we have the honour to serve, is one dealing with a certain phase of technology. Hereat, a high proportion of the members bring before each meeting reports of work carried out since they last met. From discussion, some work is confirmed by further experiment, some discarded, some earmarked for publication.

A second committee, upon which we serve, is concerned with the recruitment of youth and its training. This has not made the progress we anticipated. To a questionnaire to the district foundries, asking whether and to what extent the firms would release boys for part-time training, there was a surprisingly good response. It seemed so favourable, that provision was made for the inauguration of a new class; a lecturer was engaged and all that remained was for the boys to come along.

When it came to a show-down, the response was negligible. The course was cancelled and the lecturer's services unfortunately lost. This, in foundry parlance, was a " flop-out " and " flop-outs " have to be re-cast. The Committee obviously feels it has been pretty badly let down, but it will persevere.

The few excuses reaching the Committee were puerile. A typical one was that the boys now employed had insufficient education to benefit from technical training. From practical knowledge of this situation, we know that the principals of the selected technical colleges personally interview each lad and those unsuited for technical training are given revision courses to fit them for their later studies.

Is it possible for education committees to work on the same lines as the technical committee we cited? We think so. Primarily, every member should know, by personal visits, the administration and teaching staffs and the equipment. Then. by individual frequent contact with grouped foundry interests, there could be reports placed before the committees for discussion.

Maybe this is too theoretical a concept of a committee's work and all that has happened is that this one has been particularly badly " let down " by those whom they are striving to serve.

A fresh attempt is to be made for starting a class in September, and we ask all those foundries which expressed their willingness to support a part-time class to honour their bond and remove the tarnish of the good name of the district foundry industry. We apologise to overseas and provincial readers for once in a way dealing with something which we hope is of but metropolitan and not national concern. Yet the lesson may be of wider interest.

THE JOURNAL AND THE CRISIS

We apologise to our readers and advertisers for our inability to produce anything other than a token issue. Moreover, we are informed that we shall not be permitted to appear again until March 6.

This is due to the Government order to limit the use of electric current for essential purposes. Home readers, in the greater part of the country, will appreciate our difficulties, as their outputs for this week at least will range between zero and that of a token quantity.

Far too little effort has been made to deal with the practical requirements of industry, whilst far too much thought has been devoted to evolving schemes designed to ease pre-war ills which no longer apply in a world of shortages of materials and man-power.

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

FEBRUARY 17.

Sheffield Society of Engineers and Metallurgists :—"Metallurgical Aspects of Compressed Gas Cylinders," by N. F. Allen, M.Met., D.Sc. At Royal Victoria Station Hotel, Sheffield, at 6.15.

FEBRUARY 18.

Institute of Mechanical Engineers :—"Flow of Metals," by Dr. A. Nadar. At Storey's Gate, St. James Park, London, S.W.1, at 3 p.m. and 5.30 p.m.

Institute of Physics :—"Dielectric Heating," by A. J. Maddock, F.Inst.P., At Glasgow University.

FEBRUARY 20.

Institute of Mechanical Engineers :—"Flow of Metals," by Dr. A. Nadar. At Manchester College of Technology, Sackville Street, at 2.30 p.m. and 5 p.m.

FEBRUARY 21.

Institute of Mechanical Engineers :—"Locomotive Power at Speed," by E. L. Diamond, M.Sc., A.M.I.Mech.E. At Storey's Gate, St. James Park, London, S.W.1, at 5.30 p.m.

FEBRUARY 22.

Institute of Chemical Engineers :—"Fuel Economy in a Small Factory," by V. G. Jenner, at Manchester College of Technology, at 3 p.m.

Institute of British Foundrymen

FEBRUARY 15.

West of England Branch :—"Cupola Practice," by C. A. Payne, at Grand Hotel, Broad Street, Bristol, at 3 p.m.

FEBRUARY 19.

London Branch :—"Co-operation for Control and Research," by F. Cousans, at Waldorf Hotel, Aldwych, London, W.C.2, at 7.30 p.m.

CO-OPERATION BETWEEN ENGINEER AND FOUNDRYMAN

By "TRAMP"

To achieve best results from castings it is essential that producer and user get together occasionally to discuss such questions as machining allowance, jigging points, etc. At such meetings other points could also be discussed with advantage, for example, the necessity for large heads on certain types of cylindrical castings to ensure clean bores and a solid casting generally.

While the user desires reliable castings, he often fails to realise the necessity for the incorporation of large heads, especially when he has to remove them during a machining operation. The parting of a large head in the boring mill is often a difficult operation because of tool considerations, and it is usually an even more difficult job to remove the head which has been parted off from the machine without disturbing the spindle. The engineer often complains of this, but the founder needs the head to ensure a sound casting.

Recently such a case occurred, but was settled to everyone's satisfaction when a suggestion brought forward at a meeting of the engineer and foundryman was put into operation. This suggestion was that if the head was cut in halves or quarters by split cores during the moulding operation, it would be an easy matter to remove it from the boring mill without disturbing the spindle, an arrangement which was entirely satisfactory from every point of view.

METALLURGICAL FILMS

AN APPEAL

An appeal is made to all firms and industrial research and development organisations who have not already done so, and who own or have made films dealing with metallurgical research, or showing some scientific aspect of the production and uses of metals, to communicate with the Education Officer at the Iron and Steel Institute, 4, Grosvenor Gardens, S.W.1, from whom copies of a circular may be obtained setting out the "particulars of films" which are particularly required.

On behalf of the Joint Committee on Metallurgical Education, a list of films, including brief synopses and details regarding running time, date of publication, source from which obtainable, etc., has already been compiled on the production and uses of iron and steel. A similar list, for the non-ferrous industries, is now in course of preparation and the intention is eventually to build up a metallurgical film library of suitably graded and appraised films from which a selection can easily be made of those specially suitable for showing to colleges, schools, apprentice-trainees or specialist scientific audiences, on any subject.

At present many metallurgical films are scattered around the country and remain in places where their existence is unknown and their circulation accordingly restricted. What is needed is a central library where copies of films can be deposited and in which the booking, hiring charge, despatching and repair services can be properly handled. In this way, the cost of replacing damaged and worn prints could be covered and the films given the publicity many of them deserve.

IRISH STEEL LIMITED

Irish Steel, Limited, Haulbowline, County Cork, will be placed on the market very soon as a going concern. The company has been engaged in the manufacture of steel for several years, but war-time difficulties prevented the development of the undertaking to the extent originally intended.

During the last two years the company has been producing bar steel from billets imported from Canada. The Eire Government has a very large interest in the concern.

Production ceased about 1941 and a receiver was appointed by the trustees for the debenture holders, and remained until October 30, 1942, when the company, by agreement with the Minister for Industry and Commerce was enabled, with trade loan guarantee, to obtain working capital and proceed with the construction of open hearth furnaces and other works. Mr. Vincent Crowly has been appointed receiver.

MINISTRY OF SUPPLY details of U.K. aluminium fabrication in November last show that the castings total of 3,784 tons was made up of:—Sand, 1,500 tons; gravity, 2,083 tons, and pressure, 201 tons. Magnesium fabrication included 94 tons of castings other than bombs.

CENTRIFUGAL CASTING*

By L. NORTHCOTT, D.Sc.

The production of castings by the introduction of molten metal into rapidly rotating moulds is being practised on an increasing scale both in this country and abroad, the castings being known as centrifugal, rotary, or spun castings. There are several varieties of centrifugal castings, and it is proposed to deal with them all with the exception of those usually termed precision castings, where emphasis is not so much on centrifuging than on the type and material of the mould; in precision casting the essential feature is that of mould technique.

It is customary in American parlance to distinguish between the various types of centrifugal casting:—

(1) True centrifugal casting is one in which the mould consists simply of a cylinder which is rotated usually at fairly high speed; the metal being poured into the cylinder is maintained against the mould by centrifugal action, and the thickness of the casting depends solely on the quantity of metal poured into the mould and the size of hole in the end plates; the inner casting surface is a free surface, and is not in contact with a core. True centrifugal castings therefore are suitable for pipes, cylinders, tubes, etc.

(2) Semi-centrifugal casting refers to the case where the mould is fitted with internal cores, and is rotated about the axis of rotation of the casting, typical examples being solid or spoked wheels and gears.

(3) The third type, sometimes referred to as centrifuging, applies to those instances where the whole of the casting, apart from the runners, is away from the centre of rotation, *i.e.*, the castings are not spun around their own axis. Both types 2 and 3 can be classified under the group of pressure die castings, the pressure in this case being the centrifugal pressure caused by the rotation of the mould, in fact the process is sometimes called centrifugal die casting. Theoretically castings of any shape and size can be prepared by this method, but in practice there are certain practical limitations since the rotation of the mould involves engineering considerations which may render the process uneconomic.

The axis of rotation may be either horizontal, inclined or vertical. It is customary for true centrifugal castings to be rotated in a horizontal or slightly inclined axis and for semi-centrifugal and centrifuging processes for the axis of rotation to be vertical, but examples of true centrifugal casting on vertical axis machines is sometimes observed. The principal differentiation is for long castings to be rotated horizontally and short ones, that is, where the length is less than the width, to be rotated vertically.

An essential part of all these processes is the equipment. This consists of a mould capable of being rotated, mechanism which will rotate the mould, and apparatus to transfer the liquid metal into the mould.

Machine Design

For casting relatively small cylinders or rings, either a single or double face plate type of machine can be used. In the simpler types, which are more common nowadays, the mould is attached direct to the shaft or to a face plate connected directly to an electric motor. In the double face plate type there is a face plate at each end of the motor. For more complicated or heavier castings the motor drives through the shafting in heavy bearings to a face plate to which is attached a die holder in which is placed a die or mould, and the die holder is suitable for a number of dies of different size. For very large machines of the horizontal type, it is customary to run the rotated mould as a cradle direct on bearings, and the motor can drive either direct from one end or else it is placed at the side of the mould, which is then rotated by belt. The majority of vertical machines have an electric motor with the rotating plate attached direct to the shafting of the motor.

It will be convenient to discuss the different types of centrifugal casting process separately since the metallurgical features of groups 2 and 3, *i.e.*, centrifugal die castings are vastly different from those of group 1 or true centrifugal, yielding castings of simple cylindrical shapes.

Dealing with group 1 first, typical examples of products from this process are cylinder liners, piston ring pots, bronze bearing bushes, brass and bronze tubes, cast-iron pipe for water, sewage and gas mains, brake drums, shafting generally, gun tubes, and large heavy castings for paper mill rollers.

Much experimental work has been carried out on a small machine of the heavy type, utilising a die holder in which is placed the actual die or mould.[1, 2] It is provided with a ribbon type pouring device consisting of a basin connected to a trough into which the metal is fed. The method of pouring is of some importance; for small machines there is either a spout pourer or a ribbon pourer, giving a sideways flowing stream almost the full length of the mould. For short castings the ordinary spout pourer is satisfactory and also for thick castings of greater length, but for thin castings of appreciable length a ribbon pourer is advantageous. On the other hand, for very long thin castings—for example, cast-iron pipes—it is customary to incline the mould and retract it during casting, so that it is literally spirally fed.

German Developments

The moulds may be made of steel or cast iron and either used as chill moulds or be lined with refractory

*A Paper read before the London branches of the Institute of British Foundrymen and the Institute of Metals.

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material. This may be a convenient stage to mention two outstanding developments which took place in Germany during the war. The first was applied in the casting of long gun tubes and shafting. It will be appreciated that for the production of long, narrow castings, say, 20 ft. in length, since the mould is expanding at the same time as the casting is contracting, cracking of the casting may easily occur if there is any hold-up of the casting in the mould. The Germans have overcome this difficulty by using a thin loose silica sand lining for gun barrels and for high chromium steel shafting. The sand is poured in like molten metal while the mould is spun, the thickness is about 5 mm. —too thin a lining results in cracks and if too thick the sand tends to wash and give a wavy surface on the casting. The second development was in the use of a thin copper sheet as a lining for a cast-iron mould in the horizontal casting of bronze—to eliminate pin holes, increase mould life and improve surface finish. A 3-mm. cut on the outside and inside of a casting suffices to remove the copper sheet from the outside and dross from the inside.

Metallurgical Features

The question of pouring the metal into the mould has already been touched upon. Since directional solidification is readily obtainable it is advantageous to pour slowly once the mould is well lined with liquid metal, but to obtain this state of affairs the first pour must be fairly rapid or otherwise laps will occur. What is desired, of course, is a uniform structure, free from cracks and segregation. The rate of rotation of the mould is quite important and normally a high speed, for example, 1,000 r.p.m. or over for a 6-in. dia. casting is used. As the inside surface of the mould is smooth, the mould rotates at a higher speed than the liquid metal inside it, particularly in the early stages of casting. If the mould speed is too low, the rate of pick-up is insufficient so that the metal tumbles about inside the mould and a streaky appearance may result, where the inner zone is much less pure than the remainder.

Provided the liquid metal is of high quality, the only other serious defect likely to be encountered is of narrow bands of segregate occurring circumferentially in the casting, and there is some evidence to show that this form of segregation is associated with a steep temperature gradient and excessive vibration of the mould during the solidification period. This form of segregation may be associated with fine porosity in the segregated area suggesting that solidification occurred radially inwards and outwards at the same time, the position of the segregate defining the position where the two processes meet and the porosity being due to inadequate feeding. The porosity is only noticeable in extreme cases, but it may be particularly harmful if, as is frequently the case, the casting is subsequently machined and this operation exposes the porous areas. Trouble in cylindrical castings may also be experienced from radial cracking which is liable to occur under conditions of excessively high mould speed accompanied by rapid pouring. This form of cracking is a result of the centrifugal pressure if the rotating liquid promoting a circumferential stress in the first formed solid shell sufficiently high to crack the shell after it has contracted away from the mould. Such cracks are frequently lined or filled with segregate material.

It should be appreciated that the centrifugal process cannot overcome defects commonly associated with metal of low quality. Some alloys, of which the bronzes are typical examples, sometimes offer difficulty in casting by normal methods owing to a high gas content which leads to porous castings and the centrifugal process should not be looked upon as a universal remedy for such troubles. Coarse radial porosity associated with excessive segregation of the delta constituent taking the form of radial holes has been observed in a bronze tube casting; the defect arises from a high gas content in the melt. The only way to overcome such defects is to ensure that the melt has a low gas content. Similar defects may arise from a mould dressing leading to excessive gas evolution during casting. Examples have also been observed of the more normal type of well distributed pinhole porosity characteristic of metal of high gas content.

Apart from these examples of unsoundness it is a fact that the centrifugal process does yield cylindrical castings of high density owing to directional solidification from the mould wall. Troubles due to inter-dentric porosity and inadequate feeding are absent or at least only observed near the bore in very thick castings of small internal diameter where the centrifugal pressures involved are low. It is doubtless owing to the freedom from unsoundness that the Germans have adopted the process for castings used as raw material in the manufacture of wire.

Centrifugal and Centrifuging or Centrifugally Die Casting

These are terms which may be given to groups 2 and 3. They may be considered together since the main problems involved are similar although not identical and differ from those concerned in simple cylindrical castings. Typical examples are wheels, gear wheel blanks or other shapes symmetrical about an axis and rotated about the axis of rotation, and secondly articles of any shape rotated about an axis away from the body of the casting.

Metallurgically, centrifugal die casting differs in several respects from simple tube castings in that (*a*) the metal is in contact with the mould on all sides; (*b*) feeding has to be done from the arms or runners and the usual considerations of feeding thick sections through thin ones arise; (*c*) sand moulds are usually used in place of chill moulds so that steep temperature gradient effects are absent, and (*d*) the angular or rotational acceleration of the liquid metal is almost instantaneous so that complications arising from delayed pick-up are avoided. This last view has been confirmed by casting short sections of a wheel rim, thus preventing circulation, swirling or rotation of the metal relative to the mould; the structure of such short castings are similar to those of complete rims.

In centrifugal die castings the mould is a shaped mould constructed on the lines of that employed for static castings. The mould is attached to a bedplate which can be rotated, the axis of rotation nearly always being vertical. The mould is filled through a downgate along the axis of rotation and vertical feeder heads are dispensed with, feeding normally occurring radially from the centre of rotation and being aided by the centrifugal pressure in the liquid developed by rotating the mould. As large risers or feeders are not required, the yield of metal is appreciably higher than with static castings.

Differences between Static and Centrifugal Casting

There are several points of difference in the actual casting operation between static and centrifugal processes, which may be listed as follow:—

(1) *The Pouring Operation.*—In centrifugal castings the metal must be poured into the mould very quickly, since the metal is rapidly accelerated along the arms and tends to split up into drops as it enters the mould. Furthermore, as the metal is accelerated very quickly indeed away from the central downgate, there will be a tendency for air to be injected with the stream unless the downgate is kept filled with liquid during pouring. The effect is similar to that experienced in ordinary bottom casting, but is much more exaggerated when casting centrifugally. The point is met by the use of a stationary pouring box or, better still, a bottom pouring ladle fitted above the casting machine pouring into the feeder head fastened centrally on to the mould box. With this set-up, pouring can be extremely rapid, the time taken for filling a simple mould being only two or three seconds. Another factor to be controlled is the provision of a downgate of adequate length, since liquid metal rises up the walls of a rapidly rotating runner. The effect is independent of the density of the alloy used, but increases as the square of the speed and as the square of the runner diameter. Some margin is required, since slight eccentricity of the runner in the mould increases the effective radius of the runner. As higher rotational speeds are likely to be employed in casting light alloys than with copper base alloys, greater care over this point is needed with aluminium or magnesium base alloys.

(2) *Moulds* (*a*).—Owing to the high stresses set up during rotation, a mould required to rotate at any appreciable speed must be exceptionally strong. Sand moulds should be well rammed, be fully dried before use, and not allowed to pick up moisture through standing for any length of time in damp atmospheres after drying. In some tests carried out in 12-in. dia. moulding boxes a green-sand mould broke up at 400 r.p.m. and a skin-dried one at 800 r.p.m. in the absence of any metal. A well-dried sand mould having a dry compression strength of about 200 lb. per sq. in. withstood 1,500 r.p.m., although it was cracked. Retaining plates at top and bottom were employed to prevent break-out of sand. In order to avoid possible trouble with sand moulds, chill or permanent die moulds are sometimes used.

Another alternative is the Randupson or cement sand process in which a silica sand is mixed with about 10 per cent. of Portland cement and water. The mould can be used after drying over a period of 1½ to 2 days. A flask or retaining box is not necessary and is not used during casting. This Randupson process is employed fairly extensively in centrifugal die casting. One difficulty with moulds of high strength is increased liability towards hot tears, since the mould offers increased resistance to the contraction of the casting on cooling. For this reason the Randupson process is not suitable for casting those light alloys prone to hot tearing. The Americans are developing green-sand moulds of medium strength for centrifugal casting purposes, presumably at relatively low rotational speeds.

(*b*) At rotational speeds giving rise to pressures of more than, say, 5 lb. per sq. in., penetration of the liquid metal takes place even into quite fine sands, and a mould wash becomes essential. This particularly applies to positions struck by the stream after acceleration along the arms or runners and may warrant the use of a splash chill or core at this position when casting high melting point alloys or those of high penetrating power. With rapid pouring rates, the moulds must be adequately vented, particularly if much mould wash is used, but only a fine vent wire should be selected or the metal may be forced up the vent holes and out of the mould.

Mathematics of the Process

It is desirable that there should be a clear understanding of the relationships between rotational speed, centrifugal force, and the pressure exerted on the mould wall. Fortunately, the formulæ are few in number and quite straightforward.

Let the mass of a particle be m pounds;
the radius of rotation R feet;
and rotational velocity N revs. per min.
The centrifugal acceleration f is given by

$$f = \frac{\pi^2 \, RN^2}{900} \text{ ft. per sec. per sec.,}$$

and the centrifugal force, C, acting on the particle is given by

$$C = \frac{m\pi^2 \, RN^2}{900} \text{ poundals} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$i.e., \; C \propto mRN^2.$$

i.e., centrifugal force is proportional to the mass of a rotating part multiplied by the distance of its centre of gravity from the axis of rotation, multiplied by the square of the number of revolutions per minute. In a static casting the gravitational force, G, in absolute units is given by

$$G = mg \text{ poundals,}$$

so that the ratio $\frac{C}{G}$ gives the centrifugal force in multiples of the gravitational force, and is briefly termed "*times gravity.*"

$$\text{and } \frac{C}{G} = \frac{m\pi^2 \, RN^2}{900mg} = 0.000{,}028{,}38 \, rN^2 \quad \ldots \quad (2)$$

where r = radius in inches.

The second problem is the determination of the pressure exerted by the rotating metal on the mould

Centrifugal Casting

wall in terms of the rotational speed and dimensions of the casting. This is required not only in estimating the stresses in the mould, but is also desirable if castings have to be made at constant pressure. In a disc casting rotating about its centre, the pressure upon the mould wall is given:

$$p = 1.415 \times 10^{-6} D r^2 N^2 \text{ lb. per sq. in.} \quad \ldots \quad (3)$$

where D = density in lb. per cub. in.

i.e., $p \propto D r^2 N^2$,

i.e., the pressure on the mould is directly proportional to the density of the alloy, the square of the radius and the square of the rotational speed. The essential difference, therefore, between "times gravity" and pressure is that the first is directly proportional to the radius and the second to the radius squared. Hence, by doubling the radius of a casting, the same internal pressure is developed with half the "times gravity."

From the metallurgical angle internal pressure governs soundness, whereas "times gravity" force governs metallurgical features of structure and segregation, and these equations show that it is impossible to maintain the same ratio of these influences. To obtain sound castings with a given value of internal pressure, a whole range of "times gravity" forces is available, depending on the mean radius of rotation of the castings. As the radius is increased the revs. per min. must be reduced to maintain constant pressure and the structure and segregation obtained will more closely resemble those of static castings.

The only other equation which need be considered is that giving the shape of the parabola in vertical axis castings:—

$$y = \frac{2\pi^2 \quad N^2 \quad x^2}{g} \quad \ldots \quad (4)$$

i.e., the vertical distance or depth *y* of the parabola is proportional to the square of the horizontal radius *x*, and the square of the rotational speed. The characteristics of the metal are not involved, but the effects observed are likely to be greatest in light alloy castings, since these normally require higher speeds of rotation.

Practical Issues

The practical foundryman is likely to be more interested in an answer to the question—what benefits are to be obtained by centrifugal casting as compared with static casting? Leaving aside possible benefits from increased yield, etc., which may be considerable, the main aspect is the relative properties of sand castings prepared by the two methods. There is an extensive literature on the subject of centrifugal casting, but little dealing with a true comparison, as there has been rather a tendency to compare static sand castings with centrifugal chill castings. Discussion on the subject would be incomplete without reference to recent A.R.D. investigations into centrifugal die-casting sand moulds. Both Al-base and Cu-base alloys have been examined. The Al alloys examined were DTD 304 (4½ per cent. Cu alloy), 2L33 (12 per cent. Si alloy), RR. 50 (Cu, Si, Ni, Fe alloy) and DTD 300 (10 per cent. Mg alloy).

The work on copper alloys will shortly be published, but the results obtained with the Al alloys have already been described in some detail[2] and may be worth summarising here. For the purpose of this work a wheel pattern was selected. Samples for tensile tests were taken at three positions, (*a*) from the rim between arms; (*b*) from the rim across arm-rim junction, and (*c*) from the arms to include arm-rim junction. The overall diameter was 10 in. and the five arms were originally 1½ × ¼ in. cross section. Centrifugal castings were compared with static castings. The castings were poured down the central boss and the static castings had a substantial riser on the rim near each arm-rim junction, but there were no risers on the centrifugal castings.

Preliminary results showed that one advantage of the centrifugal process was the ability to pour at very low casting temperatures, owing to the rapid rate of pour necessary—the low casting temperature not only reduces the grain size, but also the porosity. It was also found that with ¼-in. thick arms there was pronounced evidence of surface shrinkage marks particularly at the ends of the arms where the arms joined the rim. In bad cases, say with arms of even smaller cross sections, these surface marks may extend to the rim. The effect is clearly due to the centrifugal action feeding the rim at the expense of the arms. It was found that the effect is very evident in the DTD 300 alloy containing 10 per cent. Mg where surface porosity leads, at high temperature, to rapid oxidation. Adequate soundness, however, was obtained by increasing the arm thickness to ½ in., and considerable improvement in mechanical properties was obtainable by increasing the thickness of the arms and by centrifugal casting.

These results emphasise the need for care in attempting to feed thick sections through thin ones when the thin sections are a constituent part of the casting. In general, similar types of porosity are observable in the copper-base alloys, the main difference being that in those alloys having a narrow freezing range, such as the aluminium-bronzes and high-tensile brass, the porosity tends to take the form of a single cavity as compared with more dispersed form of porosity in alloys having a wide freezing range like the bronzes. There is only one other form of porosity which is sometimes met with and, as this is so much linked up with the crystal structure, a word on structure effects of centrifugal castings is warranted here. Although, generally speaking, the crystal size of centrifugal castings is smaller, sometimes appreciably smaller, than the crystal size of the equivalent static casting, it has been found that there is a tendency for coarse crystals usually of columnar type to grow outwards from the inner vertical faces of the casting. The effect has been well illustrated in some aluminium alloys.[3] There is a tendency for unsoundness to exist at the ends of the columnar crystals, particularly when high casting temperatures are adopted.

Destruction Tests

Some tests to destruction on light alloys were carried out on complete wheels to compare the properties of the wheel as a whole as between static and centrifugal. A static casting with riser heads and a centrifugal casting prepared at 1,000 r.p.m. in each of the three alloys DTD. 300, 304 and RR. 50 were heat-treated and broken in compression in a testing machine, using adaptors machined to the outer profile of the wheel; the centre of the wheel was bored out to 2-in. dia. and a steel shaft inserted. The average compressive strength of the centrifugal castings was 16 per cent. greater than that of the static castings.

There are few comments to be made here about centrifugal casting the copper-base alloys—bronzes, brasses, etc., since this work will shortly be published. It has been shown that the pressure exerted in centrifugal casting is directly proportional to the density of the alloy. As copper alloys, steels and cast irons have a much higher density than the aluminium alloys, similar centrifugal pressures are exerted at much lower mould speeds, although, of course, the "times gravity" acting at these lower mould speeds are much lower than at the higher mould speeds used for the light alloys.

Precautions

For those thinking of adopting the centrifugal casting technique, the first precaution is to see that the machinery is well designed and adequate for the job. The machine should be rigid and bearings should be of ample size to ensure that rigidity is maintained. Vibration should be avoided as much as possible, since it is a sign of lack of balance, and lack of balance may lead to trouble in centrifugal casting as it does in other things. For this reason there is an argument for submerging machines of the vertical axis type in a casting pit. It has been estimated[4] that in the case of a mould cover held down by a number of ¾-in. bolts on a 20-in. circle spun at 1,500 r.p.m. each bolt exerts a force equivalent to that of a static weight of nearly 6 cwt. If one of these bolts broke loose, the destructive force would be equivalent to dropping a building brick on a man's head from a height of 16 ft.

Adequate splash guards are essential. In preparing some castings, it is the practice to weigh out the correct quantity of metal to be poured, but in others pouring is continued until the excess splashes out. Even in the first instance sooner or later excess metal is poured and molten metal leaving the machine at a velocity of 2,000 or 3,000 ft. per min. can, and does, travel a long way.

REFERENCES.

[1]L. Northcott and V. Deckin—Journ. Inst. Metals, 1944; 70, 301.

[2]L. Northcott and D. McLean—Journ. Iron and Steel Inst., 1945; 303.

[3]L. Northcott and O. R. J. Lee—Journ. Inst. Metals, 1945; 71, 93.

[4]J. G. Weber—American Foundrymen's Association, Publication 44-37, p. 112.

TESTING MOULDING SANDS

The inaugural lecture at the Northampton Polytechnic was given, in the absence of Mr. F. H. Hunt, by Mr. R. Whitehead, chief metallurgist of John Fowler & Company, Limited, using Mr. Hoult's notes.

The lecturer gave a brief outline of the geological formations of sands, explaining how differential sedimentation produced the whole range of washed sands, natural moulding sands. and clay. From this range of sands and clays, each varying physical properties, the founder chooses those sands or combination of sands which fulfils his particular needs. These needs, strength, permeability, flowability, refractoriness, etc., were fully dealt with, showing how they depended on the physical and chemical condition of the sand, *i.e.*, grain size, moisture, bond, silica content and fluxing constituents, and how these factors can only be maintained at the required level by constant technical supervision and control.

It was shown how the development of foundries towards full mechanisation made less demands on the skill of individual moulders, and increasing demands on technical and engineering staff. Greater strengths demanded less tolerances on sizes and machining, and more intricate coring operations all tended to intensify this trend and gave rise to the wider use of synthetic sands for moulding and the need for improved core strengths. The properties of synthetic sands were outlined and compared with "natural sands," and arbitrary test figures given.

The lecturer then described the sand testing system in operation at the Sprotborough works, how sand is controlled from stock yard to machines. This is graded continuously to maintain a consistent grain size and routine moisture compression and permeability tests are taken at half-hourly intervals throughout the day and graphed, showing any tendency to deviate from a specified range. The percentage of coal dust is determined at regular intervals through the day, both in the moulding sands and in the "fines" extracted by the desilting plant, and adjusted accordingly. It was described how, under this rigid system of control, it was possible, in the event of abnormal fluctuations of green strength or permeability to take steps to correct these faults with the minimum loss of time. Core sands were tested in a similar way both the green and dry conditions.

The lecturer ended with a demonstration of sand testing apparatus and an outline of how the figures received were utilised in correcting any errors arising.

Dr. Garside, who presided, thanked Mr. Whitehead and threw the meeting open for discussion, which lasted for 40 minutes and covered practically all aspects of sand testing and control in the mechanised foundry.

DR. ADOLPH MEYER, a director of Brown Boveri & Company, Limited, and a former director of Richardsons Westgarth & Company, Limited, told members of the North-East Coast Institution of Engineers and Shipbuilders that the gas turbine would be the "machine of the future" for ship propulsion.

CORRESPONDENCE WITH JAPAN

The Board of Trade announce that they have issued a General Licence (S.R. & O. 1947, No. 141) authorising business communications of a limited character with Japan.

Nothing in the licence authorises trade in goods or the payment or transmission of money or securities. The Supreme Commander for the Allied Powers in Japan is not prepared to allow letters containing powers of attorney, instructions involving the completion of transfers of property within Japan, or information concerning Japanese external assets to be forwarded to Japanese addresses.

The control of the Board of Trade through the Trading with the Enemy Department and the Custodians of Enemy Property over Japanese property in the United Kingdom continues in force and is not affected by this licence.

British owners who desire to obtain preliminary information on their property in Japan, through official channels, should apply to the Trading with the Enemy Department, 24, Kingsway, London, W.C.2, and should forward to that Department four copies of all letters and enclosures containing requests for such reports, for transmission to the Occupation Authorities in Japan.

As pointed out in the Board of Trade Journal of December 21, 1946, all trade with Japan is at present on a Government to Government basis, and British traders are therefore advised to apply to the Sundry Materials Branch of the Board of Trade (10, Old Jewry, London, E.C.2) for advice on whether specific commodities are likely to form part of the import/export programme for 1947, which is now being drawn up by the Supreme Commander for the Allied Powers in Japan.

PATENT SITUATION AND GERMAN TECHNICAL INTELLIGENCE

With reference to the publication by the British Intelligence Objectives Sub-Committee of reports on German Industry, and in connection with the Exhibition on this subject now touring certain regional centres, the Board of Trade point out that, although no invention made in Germany during the period between September 3, 1938, and December 31, 1945, can become the subject of a valid British patent, nevertheless some of the information gathered in Germany may be covered by valid patents or patent applications in the United Kingdom. To avoid infringing patent rights, therefore firms interested in exploiting any particular item are advised to investigate the patent position in the United Kingdom before going into production. Similar investigations are also desirable before exports are made to any particular country abroad.

U.S.A. PRODUCTION OF METAL

Ferro-alloy Metals

Production of molybdenum in 1946 was at 50 per cent. of the 1945 rate; vanadium output was 65 per cent. less, and chromite declined 75 per cent. High-grade manganese ore (35 per cent. or more manganese) and low-grade ore (5-10 per cent.) showed losses of about 16 and 43 per cent., respectively, but medium-grade ore (10-35 per cent.) made a gain of about 62 per cent. in output. Production of tungsten concentrates declined for the third consecutive year.

Copper, Lead, and Zinc

Widespread strikes at non-ferrous metal mines, smelters, and refineries throughout the first half of 1946 caused setbacks in the output of copper, lead, and zinc that could not be recouped, as of the year's end, despite the continued payment of premium prices to high-cost producers and a strong consumer demand for the metals. Smelter output of copper from domestic ores fell off fully 25 per cent. in 1946 compared with 1945. The effect was less drastic on refined lead and slab zinc, the production of which from domestic ores decreased about 12 and 8 per cent., respectively.

Light Metals

Delays in disposing of Government plants and shortages of soda ash prevented aluminium producers from meeting a demand that exceeded expectations. Output of primary aluminium in 1946 was about 16 per cent. less than in 1945, but by the end of the year all Government aluminium and aluminium reduction plants that could be operated economically under present conditions had been sold or leased to private companies, and the industry was producing at a rate 10 per cent. greater than in 1945. There was no output of primary magnesium metal in the first five months of 1946, accumulated stocks having been more than ample to supply consumers. Production of the metal from seawater was resumed at Freeport, Texas, in June, and by the end of the year amounted to one-sixth of the 1945 total. Aluminium and magnesium were the only "large-tonnage" metals whose prices in 1946 were below pre-war levels.

BIOS EXHIBITION AND INFORMATION SERVICE

The British Intelligence Objectives Sub-Committee Exhibition, which was held at the Board of Trade, Millbank, from December 10 to 19, 1946, is now on tour of the principal Regional Centres. The following dates and places have been arranged for the provincial tour of this Exhibition:—Cardiff (University College, Cathays Park—February 17 to 21); Glasgow (Kelvin Hall—March 3 to 7); Newcastle (Chronicle Hall, Westgate Road—March 17 to 21); Sheffield (City Hall—March 31 to April 4); Manchester (location not yet fixed—April 14 to 18), and Belfast (Technical College—May 5 to 9). All dates are inclusive.

FLAME SPRAYING BY POWDER PISTOL*

By W. D. JONES, M.Eng., Ph.D.

The primary difficulty which Schoop experienced with powder was due to the fact that most metal powders cannot successfully be blown through a length of tubing, for the reason that they are self-clogging and quickly pack. Schori, also working in Switzerland in the early 1920's, appears to have been the first person to realise the correct solution to this difficulty. After experimental work extending over a number of years, he developed the Schori pistol which nowadays, in substantially the same form as developed by him, is the only flame spraying pistol generally employed for the spraying of powders. The basic invention of Schori was the realisation that powdered materials could be sucked through tubes and orifices, and past obstructions where it would be impossible to blow them.

Advantages of the Pistol

Almost any metal with a melting point lower than approximately 1,600 deg. C. can be sprayed satisfactorily with the pistol. It is possible to spray most metals and alloys in the form of fine powders, and one of the advantages of the pistol is that it can successfully spray all ordinary metals such as zinc, aluminium, tin, copper, iron, nickel, etc., and industrial alloys such as brass, bronze, solder, etc. In addition, it can successfully handle many alloys which are brittle, and in this class are included cast iron, speculum metal, and certain aluminium-magnesium (*e.g.*, 50/50) alloys.

One of the peculiar attractions of this particular form of spraying pistol is its adaptability to the spraying of large surface areas very quickly. Coatings of zinc of the order of 0.003 in. can be applied at rates varying from 250 to 400 sq. ft. per hr. Consequently, as far as metals are concerned, spraying of zinc has been the chief industrial work undertaken to date by this process.

Zinc Spraying

In comparison with iron and steel, zinc is much less corrodible under atmospheric conditions, and its greyish-white corrosion product is not so unsightly as iron rust. Zinc coatings are able to provide protection for any steel exposed at gaps or breaks in the coating by the electro-chemical mechanism of cathodic protection. In the galvanic couple of zinc/iron (or steel), the ferrous material is the cathode and is protected from corrosion by the sacrificial action of the anodic zinc. As time goes on, the zinc corrosion product is deposited on the initially bare iron, giving further protection. It is necessary to point out that most sprayed metal coatings are porous, but in the case of porous zinc the galvanic action protects the iron at the base of the pores from the start of corrosion, and in due course provides enough zinc corrosion product to fill the pores entirely without serious detriment to the zinc coating, provided it is initially thick enough. Sprayed coatings are normally very thick in comparison with hot-dipped or electro-deposited zinc coatings.

In certain circumstances, zinc spraying has been shown to have many advantages over other forms of zinc coating. In comparison with galvanising treatment, for example, it has the advantage that all shapes and sizes can be coated with zinc, and that the coating is very much thicker (authorities agree that the life of a suitably applied zinc coating depends largely on its thickness). No distortion occurs during spraying, such as takes place when articles are galvanised, and a zinc sprayed surface affords an excellent key and basis for the application of paint, which is not the case with a galvanised coating.

During the war years, hundreds of tons of zinc had been used in the spraying of all types of articles. These include telephone and radio cabinets, food containers, mines, electrical junction boxes, and lifeboats, large and small naval vessels, structural steel, and many applications for the Ministry of Transport, including railways and bridges.

With the increasing cost of painting, recent months have seen much more attention being paid to the prevention of corrosion, and the application of zinc to steelwork, particularly as an undercoat for paint, has greatly increased. This is due partly to the keying effect of the matt surface of the zinc coating, but mainly to the fact that the life of a decorative paint film is determined very largely by the extent of rusting underneath it. A zinc-sprayed surface requires painting very much less frequently than one without zinc, and if suitable coats of paint are applied when necessary, the life of the surface without rusting is almost indefinite.

With the increasing scarcity and expense of steelwork and the rising cost of painting, it is likely that the application of zinc for corrosion protection in this field will be extensively developed during the next few years. Although the initial cost of application is higher than that of a paint coat, nevertheless considerable economies are observed if computed over a period of years. For this reason it is more than probable that zinc spraying will soon be applied to all structural steelwork.

The appearance and some of the properties of a zinc sprayed coating are improved by the mixture of a certain proportion of aluminium powder with the zinc, and some interesting results have been observed with the use of selected zinc alloys instead of zinc. Experiments are being undertaken by the Schori Metallising Process, Limited, in which a certain proportion of plastic composition is co-deposited with zinc during the spraying operation. The plastic so deposited fills up the pores in the zinc coating and at the same time reduces the

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* Abstracted from a Paper presented to the Sheet and Strip Metal Users' Technical Association

Flame Spraying by Powder Pistol

intensity of the electro-chemical effect on the zinc, thus prolonging the life of the coating.

Aluminium Spraying

There have been considerable developments of the powder flame spraying process in the application of aluminium for improving the heat resistance of steel. During the war hundreds of tons of aluminium powder were employed in the spraying of sheet steel flame dampers for aircraft, thus considerably increasing the life of such articles exposed to high temperatures during use. The application of aluminium in this way has, to a considerable extent, replaced other methods of increasing heat resistance involving the use of applied aluminium. Here again it appears that the development of special powdered alloys may cause a substantial improvement in this technique. One interesting aspect of the use of aluminium for corrosion protection, which probably has a considerable future, is the treatment of duralumin constructional members with applied aluminium coatings of high quality, providing improved corrosion resistance and affording a good basis for paint. There are some difficulties in the application of paint to aluminium surfaces and aluminium spraying appears to form a satisfactory solution.

Synthetic Rubber

A material which had considerable attention in the early years of development was synthetic rubber. The grade which is preferred is Thiokol—one of the polysulphides. This material received considerable development in America. During the war the main use in Britain of Thiokol sprayed coatings was in connection with marine work. For example, marine condenser doors were sprayed with thick Thiokol coatings, thus providing a door which stood up to very difficult corrosive conditions quite as well as the solid bronze doors which had been hitherto used, and which, of course, were very much more expensive. This material is particularly suited for application to sheet metal air-conditioning ducting and for the coating of casings, fan blades and the like, used for the conveyance of acid fumes. Such sprayed coatings withstand these conditions excellently and have the advantage over the older types of rubber lining made by sticking on rubber sheets, in that it is not necessary to grind down all the rivet heads or projections, which lessens considerably the amount and cost of preparatory work. Moreover, coatings of this type do not slip by centrifugal forces as commonly as those of rubber sheeting.

Thiokol was used for the protection of ships' hulls, tail brackets, and other metal parts immersed in sea water, and on a great deal of radar and electrical gear. It was also used for such applications as X-ray turntables, where good insulation is demanded. Various fillers, such as metallic lead, silica flour and pigments, can be added to the synthetic rubber for varying the physical properties. Thiokol is a material very similar in its properties to natural rubber; it has considerable flexibility, and is greatly superior to rubber in resistance to most organic solvents. It withstands most effectively precisely those solvents which attack natural rubber and many other synthetic rubbers, notably petrol, fuel oil, lubricating oil, benzene, etc., and it is unaffected by water, alcohol, dilute acids and chlorine.

Shellac

A material which is particularly easy to apply by the flame spraying process is shellac. A number of special polymerised shellac-based compounds have been developed with various fillers, particularly suited for spraying. The main industrial use of flame spraying shellac coatings has been in connection with electrical switchgear parts. During the war years considerable areas of such equipment exposed to high voltages where good electrical insulation and anti-tracking qualities are essential were sprayed. Shellac applied in this way is understood to have been one of the best anti-tracking substances yet discovered.

Apart from these engineering applications, attention is now being given to the development of shellac coatings for decorative work, an application which is still in its infancy and has been somewhat retarded owing to the increased price of raw material. However, considerable success has been achieved by the addition of suitably chosen heat-resistant pigments. Shellac can now be sprayed in any colour required, giving a strong and hard coating for many types of domestic fittings, such as standard lamps, plastic figures, and for some architectural applications, such as the decorative treatment of metal panel walls. To improve the decorative appearance, shellac (and, indeed, most plastic coatings, particularly bitumen) can be modified by the addition of mica, aluminium, bronze or coloured metal powders, or by dusting metallic powder on to the surface of the sprayed coating before it has set hard.

Other Considerations

It is necessary to consider the flame method of applying plastics in relation to other and earlier methods. It is not suggested that flame sprayed finishes will seriously displace synthetic finishes applied by brushing, dipping or air-spraying. Each has its natural field of application, and, in any case, because of the necessity of using oxygen and a combustible gas, the flame spraying method is generally considered more expensive. The finish obtained must have considerable advantages to justify the additional expense. However, some of the air-sprayed coatings do experience fundamental disadvantages. There are solubility limitations which make it possible to apply only those plastics which can be dissolved in commercial non-toxic solvents. In order to get reasonable flow properties, it is essential to apply relatively dilute solutions, which means that the coating of applied plastic is extremely thin. To obtain thick tough coatings involves the application of a considerable number of coats with the possible necessity of stoving between coats. Moreover, the necessity of eliminating the volatile solvent from the applied coating is a major problem attendant upon the spray coating of lacquer solutions.

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PARTIAL CENSUS OF PRODUCTION

By GORDON LOWE

From the hundred and one industries and trades which are to-day so heavily occupied in producing goods which will assist in the recovery of the nation, a handful have been selected to take part in an experiment. Experiments have been in the public eye recently and, whilst those associated with the determination of the root of the common cold hold an appeal for everyone, the most recent experiment of the Board of Trade is one which members of the following trades and industries will regard as an anathema: Mechanical and electrical engineering; hardware; hollow-ware; metallic furniture; sheet metal; tool and implement; chemicals; dyestuffs and drugs; clothing; hat and cap; printing; bookbinding, etc.; building and contracting.

What it is all About

In 1906 an Act was passed which gave the Government of the time power and authority to undertake inquiries into industrial production. That Act was added to by similar legislation in 1917, and again in 1939. In a changed post-war economy, the bases which were laid down in these three Acts for the collection of data essential to the statistical pundits of the Government, are both insufficient and too narrow. Consequently, with a view to broadening the basis of inquiry, a committee was appointed in June, 1945, to investigate and to make recommendations under the chairmanship of Sir George H. Nelson, this committee went into most rapid action and presented the results of its findings in something under four months—an extraordinarily brief period for a Government inquiry committee. Pressure of other Government business is probably the reason for the much longer delay in furthering action, as it was not until the end of last year that the Statistics of Trade Act, 1946, was passed. It is the execution of the powers given to the Board of Trade under this Act which will give industrial men the greatest headache since the arrival of E.P.T.

Difference between 1946 and 1947

It must be understood that the aforementioned trades are the only ones involved in the provision of data for their production in the 1946 working year. The full-scale inquiry for every industry does not come into force until the pitfalls and shortcomings of the present preliminary inquiry have been ascertained, and the then all-embracing quiz will be for the production figures of 1947. One of the purposes of the partial census is to obtain information as to industrial progress. It has been pointed out that the selected industries include certain of the more important "capital goods" industries. Last year, it is understood, was a year when all industries were engaged in conversion from war to peace production and that, although the war ended in mid-1945, the transition period was incomplete by 1946. For this reason it would be unfair to make comparison between the production in 1946 and in other pre-war years. Nevertheless, these industries have had to fight against labour difficulties and have, in part, overcome them. The information to be gleaned from these doubly hindered developments is to be the determining factor in compiling the *questionnaire* to which every manufacturer will be expected to reply for 1947.

Although some general knowledge was available about the intention of the Government through the Board of Trade, the vastness of the inquisition has shocked those chosen to assist the Director of Statistics.

This is not a courtesy inquiry, as completion of the form is compulsory and a period for making the return is allowed. By March 1, the Board of Trade should be in command of a staggering wealth of detail.

Comprehensive Forms

All producers in these industries should have received a form appropriate to their own line of business. These forms, it is reported, have been drawn up in consultation with each of the trades concerned and, from the intimate questions posed, it would seem that no aspect of production has been forgotten. It is not possible to deal with the individual questions for each industry, but a repetition of the Schedule to the Act will give the uninitiated an indication of what is coming to them. This reads:—

[Matters about which persons may be required to furnish returns under this Act.]

The nature of the undertaking (including the association with other undertakings) and the date of its acquisition: the persons employed or normally employed (including working proprietors), the nature of their employment, their remuneration, and the hours worked; the output, sales, deliveries and services provided; the articles acquired or used, orders stocks or works in progress; the outgoings and costs (including work given out to contractors, depreciation, rent, rates and taxes, other than taxes on profits), and capital expenditure; the receipts of and debts owed to the undertakings; the power used or generated; the fixed capital assets, the plant, including the acquisition and disposal of those assets and that plant, and the premises occupied.

Experience of war and shortages has made everyone reasonably efficient with the compilation of forms for licences and permits, but the presentation of the new *questionnaire* renders all previous forms insignificant. Form No. 48, for example, which is going to the hardware, hollow-ware, metallic furniture and sheet metal trades, runs to 16 pages, of which nearly one-half is given over to explanations and instructions as to the completion of the remaining 50 per cent. Unfortunately, one very important instruction has been left out—from where comes the staff necessary to search for, compile and render on the return form, the detail demanded. Although, in certain directions, the nature of the information demanded has been made somewhat simpler than in earlier censuses, in others the expansion of the ground covered nullifies the simplification procedure. National Press reception of this 1947 census in respect of 1946 production has been far from encouraging; stress has been laid upon the inadequacy of present staff facilities to cope with this additional work within a period of two months. Yet, where any manufacturer prefers to make a return for a financial period ending before November 30, 1946, the grace period allowed for compilation is reduced to one month.

At bottom, the purpose and intentions of this new census are thoroughly sound. They are to provide statistics which will enable the country to reach the economic corner and to turn around it. It is not

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LIFTING STRAPS

By "CHECKER"

Lifting straps on a large pattern are essential to ensure a good lift when withdrawing it out of the mould, and also to facilitate the easy handling of the pattern when it requires moving from the pattern shop to the moulding shop or pattern stores. Often these straps are made to screw on the sides of the pattern, with a large hole drilled in the top for the hook or chain to be fixed in, as shown in Fig. 1. A greater

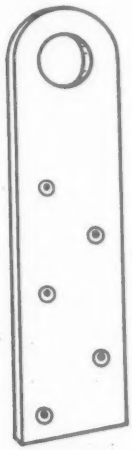

FIG. 1.

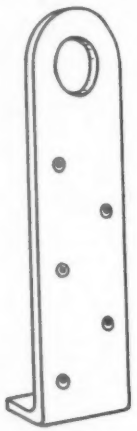

FIG. 2.

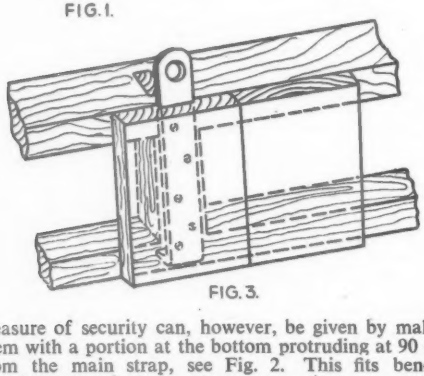

FIG. 3.

measure of security can, however, be given by making them with a portion at the bottom protruding at 90 deg. from the main strap, see Fig. 2. This fits beneath the bottom of the pattern, or under some strong support in its structure. The object of this is to give extra support to take the weight of the pattern when it is being lifted.

These lifting straps are fastened with good strong screws, or bolts if considered necessary, and can be

(*Continued at foot of next column.*)

(*Continued from previous column.*)

fixed either on to the sides, or have recesses cut out to let them become level with the face of the pattern, and so eliminate to a large extent the making up which has to be made to the mould when they are only screwed on to the outside.

When a large number of castings are required off the same pattern, it is a good policy to incorporate the lifting straps in the pattern whenever possible, so that the upper portion containing the lifting hole is the only part protruding, as shown in Fig. 3, which is the side of a bedplate, the lifting straps being fixed to the strong framework and afterwards enclosed by the built-up sides.

PRESENTATION TO CAPTAIN H. J. KENNARD, R.N.

To mark his retirement from active work in the light castings industry, Captain H. J. Kennard, R.N., was entertained to dinner at York on January 29, when his colleagues and friends in the industry made him a presentation to mark their appreciation of the services he has rendered to the industry, and to the British Ironfounders' Association as a member of its executive committee, and as chairman of other important committees. At Captain Kennard's request, the presentation took the form of a fountain pen and a gold watch.

Mr. H. V. Shelton, deputy-chairman of the B.I.A., in making the gift to Captain Kennard, paid high tribute to his services to the Association during the past twenty-five years, and referred in particular to his work as chairman of the Standing Joint Committee of Manufacturers and Merchants under the Rainwater and Soil Goods Agreement. He said that it was largely due to his sagacity and tactful handling of the many problems which arose in the administration of that Agreement that it had worked so smoothly and effectively, and on that account alone the whole section of the industry was deeply indebted to him. Others present, including representatives of the Merchant Organisations, added their tributes.

Captain Kennard, in reply, said that he was grateful for this appreciation on the part of his colleagues. He hoped that the connections and friendships he had formed with them all would not be entirely broken, and he thanked members for their kindness in recognising such services as he had been able to give.

PARTIAL CENSUS OF PRODUCTION

(*Continued from page* 159.)

evident from the information so far circulated just how this will be accomplished, but one hopes that the Board of Trade has blueprints ready for assessing and analysing machinery which will be so necessary for the conversion of unearthed statistics into concrete foundations.

Merchants and factors are to be complimented, as the purchase and resale of goods which undergo no intervening process are excluded from the scope of this compulsory inquiry.

JOHN SUMMERS & SONS

NEW CAPITAL ISSUE PROPOSED

An extra-ordinary general meeting of shareholders of John Summers & Sons, Limited, to be held on February 20, will consider proposals to increase the capital of the company from £7,800,000 to £9,480,000 by the creation of 600,000 4½ per cent. cumulative preference shares of £1 each and 1,080,000 ordinary shares of £1 each. Subject to the proposals being duly sanctioned, it is intended to offer the preference shares at 24s. per share to preference stockholders registered on January 31 in the ratio of one new share for every complete £4 preference stock then held. The new shares will entitle the holders to a first dividend of 1½d. per share, less tax, payable on May 1. The new ordinary shares will be offered at 27s. 6d. per share to holders of ordinary stock registered on January 31 in the proportion of one new share for every complete £5 ordinary stock held. The new shares will be entitled to any dividends which may be paid in respect of the year beginning January 1, 1947.

A circular issued to shareholders states that proposals have been fully discussed with the directors of the United Steel Companies, Limited, which hold £2,288,185 ordinary stock in the company, and they have indicated that United Steel Companies will take up the 457,637 new ordinary shares to which they will be entitled. Consent of the Treasury has been obtained to the proposed new issue. The proceeds of the issue will amount to £2,205,000.

Effect on Strip Mill Operations

The circular states that detailed plans of the proposed new steelworks have been prepared and approved, and the estimated cost closely approximates to the original figure of £4,000,000. The new plant has been designed for a weekly output of ingots approximately 3,000 tons in excess of the capacity of the present works. The directors are confident that the expenditure on the plant will be fully justified, not only on account of the improvement which may be expected in the cost and quality of steel produced, but also on account of the improvement in the operating results of the strip mill which should be obtained from this more adequate supply of steel.

The company's plants have had, during 1946, to meet an unprecedented demand for their products, and, despite the difficulties of present-day conditions, a larger tonnage of sheets has been delivered from the Shotton Works than ever before. The final profit figures for that year are not yet available, but it can be stated that the gross trading profit of the group will be in excess of the 1945 figure, and would enable the directors to recommend the transfer of a further substantial sum to reserve while maintaining the rate of dividend on the ordinary stock.

It is stated that the new cold-reduction plant which came into operation towards the end of 1946 is already showing substantial savings compared with the older plant which it displaced, and it is confidently expected that the new finishing equipment will show equally satisfactory results.

PROGRESS OF THE NORTH-EAST ENGINEERING BUREAU

The second annual report of the North-East Engineering Bureau, in reviewing its activities during 1946—the first full year of the organisation's existence as well as the first full year since the cessation of hostilities—points out that since the Distribution of Industries Act came into force, 56 new engineering factories have been approved by the Regional Distribution of Industry Panel. Many of these are either complete or under construction, involving a floor space of approximately 3,500,000 sq. ft. In addition to the new factories, no fewer than 92 extensions involving a floor space of approximately 3,000,000 sq. ft. have been approved. From these figures it would appear that provision has already been made for the addition of some 6,500,000 sq. ft. of factory space within the region, which it is anticipated will provide employment for over 30,000 persons. Many of the new firms will be engaged in a type of production which has hitherto been practically unknown in the North-East area and will cover light engineering in its widest term.

One of the principal functions of the Bureau, states the report, has been in connection with its capacity exchange service. During 1946, over 500 individual inquiries were received. Of these, approximately 45 per cent. came from companies outside the region, 20 per cent. from non-members within the region, and the remaining 35 per cent. came from the members themselves. It will be appreciated that it is impossible to assess the total value of this potential business, but as a very rough estimate this would have involved a turnover of more than £10.000,000 to the area, had it been possible to place it within the area. Notwithstanding the fact that many members had a heavy production programme, it was possible to convert a number of these inquiries into direct business.

FLAME SPRAYING BY POWDER PISTOL

(*Continued from page* 158.)

Flame spraying in one bold step circumvents most of these difficulties by dispensing with solvents altogether and applying the plastic by fusion. It is true that one must carefully select the plastic employed, since not only must one take into account the heat stability of the materials, which are generally complex carbon compounds, but in the case of thermo-hardening materials one has to ensure that even when the plastic has been sprayed and attached to the surface, cross-linking (or curing, as it is usually styled) does not rob the material of its ability to flow and form a continuous surface. Moreover, dimensional changes can occur in the material on cooling, and this demands careful technique on the part of the operator and the choice of a plastic with a molecular structure closely adjusted to the spraying conditions.

Scrupulous attention has to be paid to the preparation of the metal surface prior to spraying. It must be clean and entirely free from grease, and this may involve a degreasing operation. When possible, it is preferable to employ shot-blasting to give a clean, slightly roughened surface.

NEWS IN BRIEF

FURTHER INDUSTRIAL DEVELOPMENT is to be discouraged in Warwick because the position is one of industrial congestion, the Board of Trade states.

THE BOARD OF TRADE Regional Office (Wales) are moving on February 17, to Imperial Buildings, Mount Stuart Square Docks, Cardiff (telephone: Cardiff 5920).

THE SHEEPBRIDGE COAL & IRON COMPANY, LIMITED, advise that they have secured larger premises for their London office, which is now at Drayton House, Gordon Street, W.C.1.

MR. CHARLES E. BELL, who has assumed his duties as secretary of the High Speed Steel Association, will operate from Corn Exchange Buildings, Sheaf Street, Sheffield, 2 (telephone: 27536).

MAVOR & COULSON, LIMITED, manufacturers of coal-cutters, etc., of Bridgeton, Glasgow, have acquired a factory area at Swanston Street, Glasgow. They expect to enlarge their capacity for the production of coal-face machinery.

THE COUNCIL OF the Stock Exchange announce that the Marles Steering Company, Limited, having been converted into a private company, the permission to deal granted in the company's 10s. shares has been withdrawn.

PLAQUES TO BE INSCRIBED with the names of past and present presidents of the South African branch of the Institute of British Foundrymen and the South African Association of Production Engineers have been presented by Mr. G. F. Alexander. The plaques will be set up at the entrance to the lecture room in Safema's offices.

SIXTY MEMBERS of the staff of Cox & Danks, Limited, including the directors and branch managers, attended a dinner under the chairmanship of Mr. E. F. Cox, chairman and managing director of the company, at Grosvenor House, Park Lane, London, W.1, recently. The meeting was one of a series arranged to promote a close interchange of ideas and information. The company celebrate their 34th anniversary next month.

AUSTRAL IRON WORKS, LIMITED, have evacuated their former premises in Johannesburg, the last section moved being the foundry, which is now in operation at the new site. The foundry is covered by a 20-ton electric overhead crane of 70 ft. span, the mechanical portions of which were manufactured by Austral Iron Works and the structural work by Williams & Dowse, Limited. A new Broom & Wade 300 cub. ft. compressor has been installed.

PERTURBED AT THE exodus of skilled labour from Clydeside since the withdrawal of the Essential Work Order, shop stewards in the area have opened a campaign for better conditions in an effort to stem the flow. Unattractive wages and lack of general amenities were responsible for the recent loss, estimated at 10 per cent., of skilled men from the Clyde marine engineering industry, it was stated by shop stewards from the Finniston Works of Harland & Wolff, Limited, and from Barr & Stroud, Limited, at a Press conference arranged by the Scottish Reconstruction Committee.

REFERRING TO THE DELAY in announcing their dividend, the Anti-Attrition Metal Company, Limited, state that this was due to negotiations which have been taking place for the acquisition of an old-established business (the name of which is not disclosed) and the obtaining from the C.I.C. of the necessary consents for this, and also for the issue of further capital at 3s. per share. An offer is being made to the shareholders in proportion to their present holding of 1,333,333 2s. ordinary shares at 3s. per share. In addition, 666,667 2s. ordinary shares are being offered to the proprietors of the business to be acquired and they have accepted the offer.

SPEAKING AT THE annual meeting of the Parsons Engineering Company, Limited, at Southampton last week, Mr. Harry Parsons, chairman and managing director, said the demand for their heavy-duty moderate speed engine, both marine and stationary, had increased very considerably, and the sales of their conversions of the Ford and other engines had developed into an important branch of the company's business. The directors' report touched briefly on the subject of shareholders being invited to subscribe for the additional capital which would be necessary to carry out their productive expansion, he said. Arrangements were already in hand, the details of which would be circulated in the near future.

THE BOARD OF TRADE announce that, by arrangement with the Postmaster-General, they have issued a general licence authorising business communications of a limited character with Japan. The control of the Board through the Trading with the Enemy Department and the Custodians of Enemy Property over Japanese property in the United Kingdom continues in force and is not affected by this licence. British owners who desire to obtain preliminary information on their property in Japan, through official channels, should apply to the Trading with the Enemy Department, 24, Kingsway, London, W.C.2, and should forward to that department four copies of all letters and enclosures containing requests for such reports, for transmission to the occupation authorities in Japan.

THE MOST SERIOUS DIFFICULTY they had to overcome was the shortage of castings, said Mr. Harry S. Broom, chairman, presiding at the annual meeting of Broom & Wade, Limited. Until quite recently, they had been dependent on outside supplies for a large proportion of their castings, but they foresaw that the manufacturers would be likely to reduce their supplies to them, in order to meet their own requirements. Consequently, they set about the task of reorganising their own foundry. So far they had managed to double their output of castings, but they were planning for the further mechanisation of as much of the foundry as possible and a good deal of the plant and machinery was already being installed. When the work was finished, he thought it would be safe to say that they would have one of the most up-to-date foundries in the South of England.

IN PARLIAMENT

Stimulating Industrial Production

The appointment of a national commission to prepare a five-year plan for the stimulation of industrial production is proposed by 12 Labour M.P.s in a motion to be debated in the House of Commons on a date to be fixed. The motion states that this House, welcoming the publication of the White Papers on Britain's economic position, is of the opinion that a five-year plan should be prepared in consultation with all engaged in industry, that plans should be prepared for each industry to fit into the national plan, and that such plans should be subject to modification and adjustment each year in accordance with the previous year's experience and resources available. The Government is urged to set up a national planning commission to prepare plans, targets, and delivery dates; to allocate resources and economic development; to provide central and regional direction; and to co-ordinate industrial policy. The motion further urges the Government to encourage research, efficiency, and processing; modernisation of production, and the obtaining of maximum output, and to introduce efficient costing and the publication of statistical information, such as output per man-hour, horse-power per man employed, and all vital statistics, to enable the people to measure each industry's contribution towards the nation's economic development.

Scottish Iron and Steel Industry

MR. GALLACHER asked the Minister of Supply whether anything was being done to implement the proposals of the Brassert Report, the White Paper on iron and steel, and the plans of the Clyde Valley Regional Planning Commission, with special reference to the need for an integrated steel plant, at or near Inchinnan, Renfrewshire.

The various proposals for the modernisation and development of the industry in Scotland and elsewhere were being carefully examined by the Iron and Steel Board, said MR. WILMOT. The establishment of a fully integrated plant involved difficult technical and social considerations, and, while the Board were doing everything possible to speed up the discussions, it would be some time before final decisions could be made.

Import Duty on Belgian Steel

MR. J. LEWIS asked the President of the Board of Trade if he would take immediate steps to abolish the import duty on steel imported from Belgium, in view of the fact that the high price, plus the duty, made it uneconomical to purchase the material.

MR. BELCHER, who replied, said that the President of the Board of Trade had consulted the Minister of Supply in this matter. Under present arrangements, supplies of steel for consumption in this country were imported from abroad, including Belgium, almost wholly on public account. For such imports, the duty did not enter into selling prices in this country. They were not, therefore, prepared to recommend its removal.

OBITUARY

MR. THOMAS J. VOISEY, managing director of T. J. Voisey, Limited, machinery, iron, steel and scrap merchants, of Bristol, has died at the age of 61.

MR. WILLIAM VENTERS, who died at Kirkcaldy on January 31, was managing director of the former Steel Pipe Company, Limited. He was 69 years of age.

MR. HARRY GARRATT, who founded with his brother, Mr. W. J. Garratt, the firm of W. J. & H. Garratt, manufacturers of pressed-steel conduit boxes and electrical fittings, of Bloxwich, Staffs, has died at the age of 59.

DR. OTTO SUSSMAN, who has died in New York at the age of 68, entered the service of the American Metal Company in 1904, eventually becoming chairman. He was vice-president of the United States Metals Refining Company. Dr. Sussman was a Bavarian by birth.

MR. E. P. M. DAVEY, who has died at Westbury-on-Trym, Bristol, at the age of 74, was formerly secretary of John Lysaght, Limited, a position held previously by his father. After leaving the company, Mr. Davey was associated with his brother, Mr. Clarence Davey, with Metal Agencies, Limited. He retired from business in 1935.

PRICES OF CHROME ORE AND CONCENTRATES

The following prices for chrome ore, which took effect on February 1, have been announced by the Ministry of Supply. Two prices are quoted for each grade, one to be charged where delivery is made ex-ship and the other where the material is despatched from stores. The Ministry of Supply endeavour to deliver ex-ship wherever possible, but cannot accept orders on this basis. The following prices are per ton ex-ship and per ton ex-store respectively:—

REFRACTORY GRADES—Rhodesian Imperial grade, £9 17s. 6d., £10 15s.; Transvaal 1st grade, £8 2s. 6d., £9; Sierra Leone, £9 10s., £10 7s. 6d.; Philippine, £9 £9 17s. 6d.; Indian, £9 2s. 6d., £10.

METALLURGICAL GRADES—Rhodesian washed concentrates, Rhodesian lumpy metallurgical, and Baluchistan, £10, £10 17s. 6d.

High-speed Pouring of Brake Shoes

By means of centralised mechanical pouring, push-button controlled, the American Brake Shoe Company have succeeded in pouring 370 brake-shoe moulds in an hour, the total metal weighing 11 tons. The heart of the system consists of six ladles, each holding 500 lb. of metal, each ladle being supported by an individual lift cable and also fixed supports for pivoting each ladle. When a mould is full, pouring is stopped by either an electric eye or by push-button, the latter method being also employed to return empty ladles to a horizontal position for refilling. A full description of the plant by J. R. SHEPARD and W. J. OLSON appeared in "Iron Age," December 5, 1946.

PERSONAL

MR. H. H. ASTON has been appointed a director of the Simplex Electric Company, Limited, a subsidiary of Tube Investments, Limited.

MR. CHARLES A. CHANDLER, of Baxendale & Company, Limited, has been appointed chairman of Edinburgh and Leith Metal Merchants' Association.

MR. E. L. PITT, manager of the Birmingham branch of Cox & Danks, Limited, has been appointed a director of the company. He has been with the firm for 16 years.

MR. ARTHUR E. FOX, 4, Woodlands Drive, Worksop, Notts, has been appointed to succeed LT.-COL. G. A. LEWIS as secretary of the Midland Counties Institution of Engineers.

MR. S. J. WRIGHT, Director of the National Institute of Agricultural Engineering since its inception in 1942, will shortly be leaving the Institute to join the Ford Motor Company, Limited.

MR. W. H. WATSON, a technical expert, has been co-opted to the board of Platt Bros. & Company, Limited, textile and general engineers, etc., of Oldham. He was appointed technical manager of the company in 1941.

MR. R. W. P. HOLT has been appointed to the board of the Widnes Foundry & Engineering Company, Limited. He joined the company on reorganisation in 1925. The business was acquired by Thos. W. Ward, Limited, in 1937.

MR. W. V. HODGSON, who has resigned from the boards of B.S.A. Tools, Limited, and Burton, Griffiths & Company, Limited, has been appointed London area manager of A. C. Wickman, Limited, in succession to MR. J. M. MORRIS, who has resigned.

SIR ERNEST DARWIN SIMON, governing director of Henry Simon, Limited, and Simon-Carves, Limited, who was raised to the peerage in the New Year Honours List, has taken the title of Baron Simon of Wythenshawe, of Didsbury in the City of Manchester.

SIR ERNEST MURRANT, chairman of Furness Withy & Company, Limited, has been nominated as president for 1947-48 of the Chamber of Shipping. SIR GEORGE P. CHRISTOPHER, who has been nominated as vice-president, is a director of the Roath Engineering Company, Limited.

SIR MURRAY STEPHEN, chairman of Alexander Stephen & Sons, Limited, and MR. H. B. ROBIN ROWELL, chairman of R. & W. Hawthorn, Leslie & Company, Limited, were re-elected president and vice-president respectively of the Shipbuilding Conference at the annual general meeting in London.

MR. GEORGE S. JENKINS has been appointed Divisional Preparation Engineer for the Scottish Division of the National Coal Board. He joined the staff of the Fife Coal Company, Limited, in 1927, as chief chemist, and from 1934 has held the post of fuel technologist and head of the company's preparation department. Mr. Jenkins was formerly chief chemist to the Lanarkshire Steel Company, Limited. He is vice-president of the Scottish section of the Institute of Fuel.

MR. W. B. BAMFORD, assistant to the late Mr. W. Wood, who was for 24 years in charge of the non-ferrous metals branch of Thos. W. Ward, Limited, has been appointed in control of the department. His chief assistant will be MR. H. BUNKER, who for the past five years has handled the company's non-ferrous metals business in Birmingham and the Midlands. Mr. Bunker is succeeded in the latter area by MR. H. S. RIPPON, who will operate from the company's Birmingham office.

MR. W. M. RATCLIFFE has relinquished his position as managing director of Heenan & Froude, Limited, owing to ill-health. He will continue to serve the company as joint managing director with MR. F. J. FIELDING, who has been appointed to share that office. MR. A. H. LANGFORD, who has been associated with the company for 35 years—16 years as works manager and three years as general manager—and MR. R. V. ROWLES, who has been connected with the subsidiary, Fielding & Platt, Limited, for 30 years—11 years as a director—have both been elected directors of Heenan & Froude, Limited.

COMPANY RESULTS

Shanks & Company—Dividend of 15% (10%).

John Bolding & Sons—Final dividend of 12½% (10%), making 17½% (14%).

Wombwell Foundry & Engineering Company—Interim dividend of 6% (same).

Smith's Dock Company—Final dividend of 8% (7%) and bonus of 2% (nil), making 10% (7%).

Steel Developments—Profit for 1946, £4,589 (£4,583); final dividend of 3%, making 5½% (same); forward, £6,086 (£5,917).

Duple Motor Bodies—Interim dividend of 5%, being a maiden distribution, per annum for the 8½ months ending March 31, 1947.

Tomlinsons (Rochdale)—Net profit for the year ended June 30, £7,554 (£5,003); to general reserve, £5,000 (same); dividend of 10%, £1,100 (£1,000); forward, £4,482 (£4,272).

Industrial Plant Company—Gross balance of profit for the year to November 30, £794 (£775); income-tax, £409 (£401); net profit, £384 (£374); to reserve, £100 (£150); dividend of 6% (same); forward, £407 (£477).

R. A. Lister—Aggregate profits of the company and its wholly-owned subsidiaries for the year ended September 30, after making provision for depreciation, etc., £408,636; taxation, £209,357; credits of previous years arising out of the settlement of Government contracts, etc., £183.786; taxation thereon, £178,711; retained by subsidiary companies, £28,465; net profit of R. A. Lister, £175,889 (£137,077); preference dividend, less tax, £9,450; ordinary dividends, £80,025; written off goodwill in the purchase price of a new business, £9,996; forward, £150,254 (£73,836).

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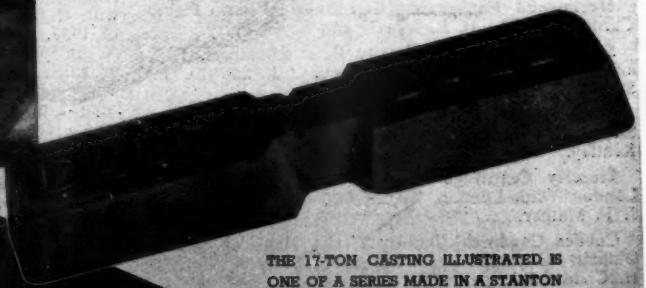

THE 17-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON

1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit

The
STANTON IRONWORKS
COMPANY LIMITED
NEAR NOTTINGHAM

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

British Shot-Blast & Engineering Company—£2,000. H. Sly, 55, Gorse Avenue, Stretford, Lancs.

Tipton Non-ferrous Foundry, Berrington Chambers, 93, Tettenhall Road, Wolverhampton—£2,500.

Makall Engineering Company, Berrington Chambers, 93, Tettenhall Road, Wolverhampton—£1,000.

Lenton Engineering Company, Lombard House, Lower Parliament Street, Nottingham—£7,000.

Cathcart Engineering Company, 93, Hope Street, Glasgow—£2,000. G. Neilson and W. B. Bird.

Chain Annealing Company, Milton Works, Egerton Lane, Sheffield—£3,000. E. C. and P. C. Wilson.

Heathwood Engineering Company, 9, Park Place, Cardiff—£2,000. B. L. Morris and K. G. Perry.

St. Annes Engineers, County Bank Chambers, 1, 2 and 3, Fishergate, Preston—£5,000. J. and N. B. Sadler.

Plant Engineers (Coventry), Chester House, High Street, Coventry—£1,000. W. L. Tyler and F. W. Keatley.

Moseley Centrifuge & Engineering Company, 62, London Wall, London, E.C.2—£1,000. F. Neill and J. F. Mather.

Cobden Chadwick, Century Works, Havelock Street, Oldham—Engineers and machinists. £25,000. C. and H. Chadwick.

Twiggs Rolling Mills, Holt Street, Birmingham—£10,000. L. Cooklin, E. P. Booth, D. A. Jacobs, and G. S. Phillips.

E. H. Walker, Alma House, Rodney Road, Cheltenham—Engineers, founders, etc. £1,000. E. H. Walker and H. E. Elsden.

T. Caddy & Sons, 8, Mill Hayes Road, Burslem, Stoke-on-Trent—General engineers, etc. £5,000. T., L., and A. Caddy.

Wharf Welding Company, The Wharf, Coventry Road, Hinckley—£1,000. A. W. Burton, A. G. Tiptaft, and W. Carroll.

Pinching & Walton, 52, Cannon Street, London, E.C.4—General and electrical engineers. £10,000. W. H. and N. H. Walton.

Sheffords—Machinery and metal merchants, etc. £1,000. S. W. T. Wood, Leongatha Lane, Hythe Field Avenue, Thorpe Road, Egham.

Miller, Gibb & Company—Gunmetal merchants, etc. £30,000. G. J. Pavillard, 182, Liverpool Road, Crosby, Liverpool, 23, subscriber.

Turner's Engineering Products, Burley House, 5-11, Theobalds Road, London, W.C.1—£3,000. H. J. and G. E. Turner, and R. W. Thomas.

Telescopic Engineering, The Bittoms, South Lane, Kingston-on-Thames—Engineers, etc. £5,000. D. V. M. Lamb, J. Turnbull, and G. D. Langley.

Richard Crittall (Industrial Plant & Equipment), 156, Great Portland Street, London, W.1—£1,000. J. L. Musgrave, R. G. Crittall, and A. E. Hinds.

Gaston Constructions—Constructional and general engineers, etc. £5,000. R. M. Lucas, 3, The Crescent, Watford Road, North Wembley, subscriber.

G. & D. Donaldson, Bardon Works, Kirkby Trading Estate, Kirkoy, Lancs—Mechanical engineers, etc. £1,000. G., D. W. and W. M. Donaldson.

BRITISH IMPORTS IN 1946

HIGH FIGURES FOR IRON ORE

The quantity of iron ore imported into the United Kingdom during 1946 (6.6 million tons, compared with 4.1 million tons in 1945) was, with the exception of 1937, the highest recorded in any year since 1916. As in pre-war years, Algeria and Sweden together provided about half our total supplies, but to the pre-war figures should properly be added the substantial imports of Swedish ore exported *via* Narvik and consigned from Norway. A considerable part of the increase compared with 1938 was in imports from Newfoundland and Sierra Leone. Imports of iron and steel scrap, which included substantial quantities of battlefield scrap from Germany, were at about two-thirds of the pre-war level. Compared with 1938, imports of both pig-iron and finished steel were negligible throughout the year, but steel ingots were three times those in 1938, and semi-finished steel was within one-eighth of the 1938 total.

Among the non-ferrous metals, the most important feature was the very high importation of aluminium in the second half of the year. These shipments, the first substantial supplies since 1944, brought the total for 1946 to 92,000 tons—double the pre-war figure. Retained imports of copper exceeded those in 1938 by one-tenth, but this increase was more than accounted for by the present negligible quantity of re-exports. Imports of tin ore and concentrates and of lead were about seven-eighths and two-fifths respectively of the pre-war figures. The quantity of machinery imported (43,000 tons—one-third of which was agricultural machinery) was about one-third of that in 1938.

Imports of Iron Ore, Iron and Steel, Copper and Aluminium in 1946.

	Quantity.			Value.
	1938.	1945.	1946.	1946.
	Thousand tons.			£ million
Iron ore	5,164	4,071	6,600	£18.7
Scrap steel	632	178	443	1.6
Pig-iron	395	108	20	0.2
Steel ingots	23	36	75	1.0
Semi-finished steel	353	81	309	5.0
Finished steel	480	34	47	1.5
Aluminium	46	21	92	7.0
Unwrought copper*	260	144	285	20.2
Tin ore and concentrates	55	45	47	9.2

*Retained imports.

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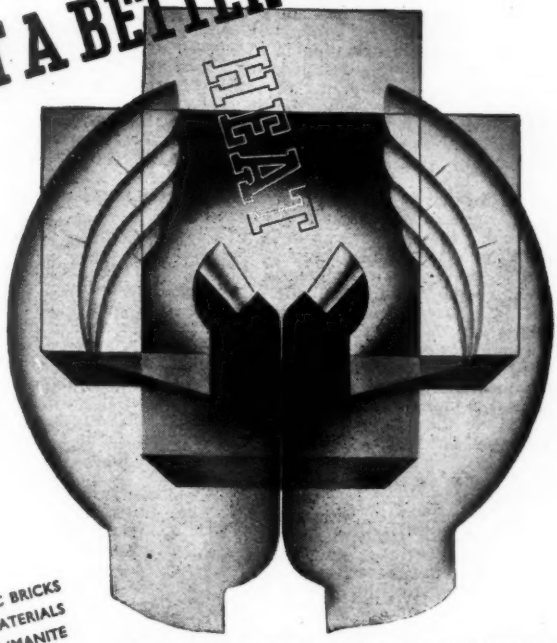

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Raw Material Markets

IRON AND STEEL

As yet there is no news of any blast furnaces being blown out, apart from one small-capacity furnace in Scotland, but in many cases production of pig-iron has been adversely affected by the scarcity of fuel and also by irregular deliveries of iron ore. Every effort is being made to keep the blast furnaces in operation in the hope that the fuel supplies will be speedily restored. Certainly there is an eager market for all grades of pig-iron. Foundrymen are getting a bare sufficiency of No. 3 iron, the whole of the output of basic iron is retained for steelworks' use, and available supplies of other grades, more particularly hematite, fall short of industrial requirements.

One of the first effects of the fall in steel production is the curtailment of supplies of steel semis. Deliveries to the re-rolling works will, it is feared, show a progressive decline, and as imports have also shrunk, operation of the mills will probably be intermittent. The sheet mills are not so badly placed, but the dearth of small billets is now pronounced and the arrival of overseas supplies is eagerly awaited.

The sheet mills are still running at or near maximum capacity and have in hand an abundance of orders which will suffice to keep them fully employed until the autumn. There is, in fact, a famine in sheet steel world wide in its incidence and the motor industry could certainly absorb tonnages far in excess of its restricted allocations.

Shipbuilders and other priority users are still getting their full quotas of plates from the steelworks' stockyards, but production is not keeping pace with the demand and as stocks are dispersed the stringency threatens to become more acute. There appears to be no alternative to the further restriction of export quotas. For other classes of finished steel the demand is unabated, but having regard to the uncertainties of the outlook, makers of finished steel products are disinclined to add to their already heavy commitments.

NON-FERROUS METALS

The fuel crisis has seriously affected deliveries of non-ferrous metals. The output of semis has, of course, been curtailed by the industrial fuel cuts and it may be expected that fabricators and foundries will hold up scrap deliveries owing to the congestion likely to be caused if normal deliveries are made.

Strikes are retarding copper production in Canada and these may well affect the Ministry of Supply's programme. The repercussions of the labour disputes in Chile at the end of last year are also being felt, so that the copper supply position at the present time is not too healthy.

The announcement that stocks of zinc in the United Kingdom at the end of November last totalled 38,400 tons gives a good idea of the low level to which stocks have fallen. Never at any period during the war years did stocks reach anything like such a low level. The November figure is nearly 110,000 tons less than a year previously.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patent)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. *each.*

582,579 HIGH DUTY ALLOYS, LIMITED, and GROSS, P. Production or refining of aluminium.

582,587 MATHEW, C. B., and AMBROSE, J. G. Inflatable cores for use in casting hollow concrete units.

582,652 ELECTRO METALLURGICAL COMPANY. Cast-iron articles.

582,718 CALLITE TUNGSTEN CORPORATION. Hard facing alloy.

582,728 BRADBURY, T. F. Aluminium copper alloys or alloys.

582,732 HALL, H. C., and WHEELER, M. A. Aluminium alloy having low coefficient of expansion.

582,776 GIBBONS BROS., LIMITED, and JONES, J. H. Means for rolling metal ingots or the like.

582,777 DUFFIELD, F. L. Production of metals from their ores.

582,778 GREENWOOD, F. Machines for producing angle-iron rings.

582,819 FORD MOTOR COMPANY, LIMITED. Mould patterns for use in the casting of metals.

582,846 BAILEY, R. W., STARLING, P. P., BURTON, H. H., WINDER, A. B., METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, and ENGLISH STEEL CORPORATION, LIMITED. Casting metals.

582,847 STARLING, P. P., BURTON, H. H., WINDER, A. B., METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, and ENGLISH STEEL CORPORATION, LIMITED. Production of metal castings.

582,898 FORD MOTOR COMPANY, LIMITED. Method of and mould for casting hollow articles.

582,901 BRIX, U. H. Bearing surfaces of light metals and their heat-treatment.

582,919 HIGH DUTY ALLOYS, LIMITED, and GOLDBERG, A. Metal window and like frames.

582,921 POWDERLOYS, LIMITED, and TRENT, E. M. Process for separation and recovery of hard constituents from sintered hard metals.

582,962 SMITH, A. B., and SMITH, C. R. Moulding appliances for casting metals.

583,003 DU PONT DE NEMOURS & COMPANY, E. I., HULL, R. O., and GRAY, A. G. Electrodeposition of copper.

AT THE CZECHOSLOVAKIAN EMBASSY on Tuesday, February 4, Dr. Císar, the *chargé d'affaires*, presented Mr. V. C. Faulkner, editor of the *Foundry Trade Journal*, with an illuminated diploma conferring upon him honorary membership of the Czechoslovakian Foundrymen's Association.